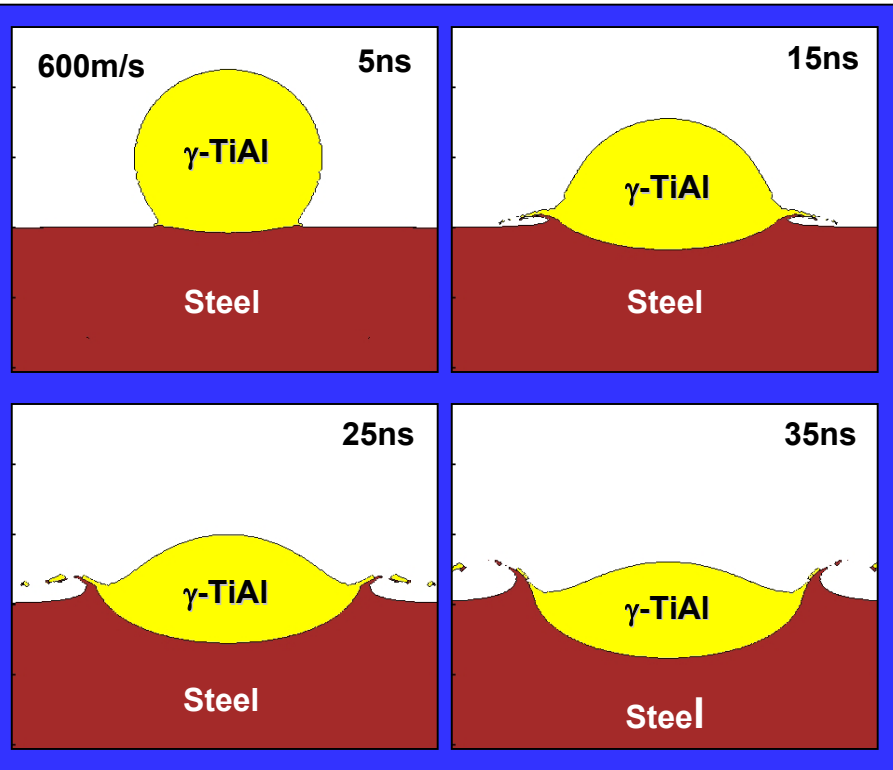


Dispersed-phase Transformation Toughening of Lamellar γ -TiAl + α_2 -Ti₃Al Intermetallics

Mica Grujicic, Clemson University, DMR Award #9906268

Dynamic Cold Spray Deposition

- An isentropic, one-dimensional model has been developed to analyze the dynamics of dilute two-phase (feed-powder particles + the carrier gas) flow during the cold spray process. The results obtained show that there is a particle-velocity dependent, carrier-gas invariant optimal value of the relative gas/particle Mach number which maximizes the drag force acting on feed-powder particles and, hence, maximizes the acceleration of the particles.
- The cold-gas dynamic spray process is analyzed by numerical modeling of the impact between a single spherical feed-powder particle and a semi-infinite substrate. The results obtained indicate that the dominant particle/substrate bonding mechanism is based on an interfacial instability which can lead to the formation of interfacial roll-ups and vortices which play a significant role in attaining the high interfacial strength.



Representative Publications

M. Grujicic, J. R. Saylor, D. E. Beasley, W. S. DeRosset and D. Helfrich, "Computational Analysis of the Interfacial Bonding Between Feed Powder Particles and the Substrate in the Cold-gas Dynamic-spray Process", Applied Surface Science, Vol 219/3-4 pp. 211-227, 2003.

M. Grujicic, W. S. DeRosset and D. Helfrich, "Flow Analysis and Nozzle-shape Optimization for the Cold-gas Dynamic-spray Process", Journal of Engineering Manufacture, accepted for publication, July 2003.

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Training

- 3 MS graduate students (Jon DeLong, Mohan Chittajallu and Chunling Zhao) and 1 PhD student (Guoxin Cao) have participated in this research.
- 1 Clemson University undergraduate student (Daniel Perry) completed his undergraduate research project.
- 1 NSF-sponsored REU undergraduate student spent ten weeks during the summer participating on the project.
- Jon DeLong was recruited by the General Electric.
- The P.I. was invited to write a review paper to International Journal of Multiscale Computational Engineering.

Outreach

- The research was presented to the group of 50+ high-school students when they visited Clemson University during the Science and Technology Week.
- The research was also presented to the class of 100+ Clemson University freshmen students in the general engineering in order to introduce them to the field of Materials Science and Engineering.
- Presented the work to a junior class of 20 honor students in the Department of Mechanical Engineering in order to get them interested in doing their Senior Research project in Materials Science and Engineering.

Department of Mechanical Engineering



Summer Research Experiences for Undergraduates

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